



TWIN STATE ENVIRONMENTAL CORP.

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June 18, 1999

Mr. Kendall Legendre
Fred W. Lewis Oil Co., Inc.
33 Lewis Court
St. Johnsbury, Vermont 05819

**RE: SITE Investigation Report – Lewis Oil Bulk Storage Facility;
St. Johnsbury, Vermont
TSEC Project #98-112
SMS Site #98-2484**

Dear Mr. Legendre:

Twin State Environmental Corporation (TSEC) has prepared the enclosed SITE investigation report to detail the findings of recent subsurface investigation activities at the Lewis Oil bulk storage facility located on Bay Street in St. Johnsbury, Vermont (SITE). The activities were completed following a request on September 30, 1998 by the State of Vermont Sites Management Section (SMS) to perform SITE investigation in accordance with a letter from Mr. John Schmeltzer dated February 17, 1999.

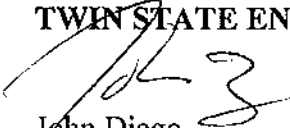
This investigation was designed to determine the degree and extent of petroleum contamination within the overburden soils and groundwater beneath the SITE. Ten (10) soil borings were advanced throughout the SITE, with four (4) completed as groundwater monitoring wells. A total of six (6) monitoring wells are now on SITE. Laboratory analysis and field screening of groundwater and soil samples collected indicate that petroleum compounds have impacted soil and groundwater exceeding Vermont regulatory guidelines.

We have recommended that results of this study be evaluated with findings of recent environmental site assessments on adjacent properties and also in consideration of the historical use of the SITE and of adjacent properties before additional investigations, monitoring or remediation plans are proposed. This SITE, from a geological perspective, is a very small portion of a much larger geological formation that has historically been under stress due to past and current uses including; a railroad yard, neighboring bulk storage facilities, several adjacent retail gasoline service stations and numerous underground storage tanks.

Lewis Oil Co.
St. Johnsbury, Vermont
June 16, 1999

Please do not hesitate to contact me if you have any questions regarding the enclosed report. I can be reached via e-mail at johnd@twinstateenvironmental.com, or at (802) 654-8663 x102.

Sincerely,
TWIN STATE ENVIRONMENTAL CORPORATION



John Diego
Vice President
encl.

cc: Mr. John Schmeltzer, VT SMS

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Phase (check one)	Type (check one)
<input checked="" type="checkbox"/> Site Investigation	<input type="checkbox"/> Work Scope
<input type="checkbox"/> Corrective Action Feasibility Investigation	<input checked="" type="checkbox"/> Technical Report
<input type="checkbox"/> Corrective Action Plan	<input type="checkbox"/> PCF Reimbursement Request
<input type="checkbox"/> Corrective Action Summary Report	<input type="checkbox"/> General Correspondence
<input type="checkbox"/> Operations & Monitoring Report	

SITE INVESTIGATION REPORT

June 18, 1999

Fred W. Lewis Oil Co., Inc.

SMS Site #98-2484
TSEC Project #98-112

Report Prepared for:
Fred W. Lewis Oil Co., Inc.
33 Lewis Court
St. Johnsbury, Vermont 05819
Contact: Mr. Kendall Legendre

Written By:

Roger C. Binkerd
Engineer

Roger C. Binkerd
(1075)

Reviewed By:

John R. Diego
Vice President

John R. Diego

1.0 INTRODUCTION

This report has been prepared by Twin State Environmental Corp. (TSEC), under agreement with Fred W. Lewis Oil Company, Inc., (Lewis Oil) to present the findings of our recent subsurface investigation conducted at the Lewis Oil bulk petroleum storage facility (SITE). The Lewis Oil bulk petroleum storage facility is located on Bay Street, in St. Johnsbury, Caledonia County, Vermont (see SITE Location Map, **Figure 1** and SITE Plan, **Figure 2**). This investigation has been completed in response to a September 30, 1998 request from the State of Vermont Sites Management Section (SMS) to:

- further define the degree and extent of contamination to soil;
- determine the impact, if any, on air space beneath the site and adjacent buildings;
- determine the degree and extent of contamination to groundwater;
- assess the potential for contaminant impact on sensitive receptors;
- determine the need for long-term treatment or monitoring;
- recover any free product in excess of 1/8th inch;
- submit a summary report that outlines the work performed that provides interpretations and recommendations pertinent to the SITE.

A work scope and cost estimate to perform the work presented within this report was approved by Mr. John Schmeltzer of the SMS on February 17, 1999. A copy of the approval letter is presented as **Attachment 1**.

2.0 BACKGROUND / PREVIOUS WORK

The September 30, 1998 letter from the SMS was drafted as a result of findings by Tewhey Associates who conducted a Phase II Environmental Site Assessment (ESA) for their client Canadian Pacific Railway. Lewis Oil Company leases the SITE from the Canadian Pacific Railway. The Phase II study by Tewhey Associates encompassed the entire St. Johnsbury railroad yard. The property leased and occupied since approximately 1990 by Lewis Oil Company is a relatively small portion of the railroad yard. Gossco Co., and Gulf Oil Co., previously occupied the bulk storage. The SITE is adjacent to the train track since in the past railroad was the principle means of transporting fuel oil. The train would stop adjacent to the SITE and transfer fuel directly to above ground storage tanks (ASTs). Off loading of fuel by train took place before Lewis Oil Company leased the site. Since Lewis Oil has occupied the SITE fuel deliveries to the storage facility are by truck transport.

As part of Tewhey Associates Phase II study, four (4) test pits were dug and two monitoring wells were installed on the SITE. The two monitoring wells were labeled GP-4 and GP-5 by Tewhey Associates and are located adjacent to the concrete retaining wall on the east side of the SITE. Groundwater samples collected by Tewhey Associates from these monitoring wells indicated that the groundwater was contaminated with petroleum products. Also, soils collected from the test pits dug on the SITE indicated petroleum contamination. Since Tewhey Associates did not analyze the groundwater samples for volatiles, the SMS in the September 30, 1998 letter asked that Lewis Oil have their consultant "as soon as possible, sample existing two monitoring wells and analyze samples for BTEX, MTBE and TPH." TSEC sampled these two monitoring wells on November 25, 1998 and reported the results to the SMS on January 6, 1999. Samples collected by TSEC confirmed the presence of petroleum hydrocarbons in monitoring wells GP-4 and GP-5.

Subsequently, TSEC prepared a work plan and cost estimate and submitted it to the SMS on January 22, 1999. The SMS approved the work plan on February 17, 1999. The subsurface investigation portion of this work plan was conducted on March 23 & 24, 1999, and groundwater sampling activities were conducted on April 21, 1999.

3.0 SCOPE OF WORK

The following activities were performed as part of this investigation as outlined by TSEC's January 22, 1999 work scope/cost estimate:

- Preparation of a SITE specific health and safety plan that conforms to OSHA 40 CFR 1910.120.
- Clearance of the SITE and vicinity for underground utilities by contacting DIG SAFE (Clearance # 19991202128 was obtained) and other local utilities.
- Advancement of ten (10) soil borings using Geoprobe® Direct Push technology in the vicinity of the bulk petroleum storage facility ASTs. Continuous soil samples were collected, logged, and field screened for the presence of volatile organic compounds (VOCs) using a photoionization detector (PID) equipped with a 10.6 eV lamp. Four (4) soil borings were completed as groundwater monitoring wells (MW-1, MW-2, MW-3 and MW-4) using 1-½ inch diameter PVC well materials. These wells were developed in accordance with TSEC's standard operating procedures following installation.
- Completion of a detailed SITE survey and updated site plan.
- Completion of a receptor assessment that determined the potential for petroleum contamination to affect nearby building basements, surface water bodies, etc.
- Collection of groundwater samples from all SITE groundwater monitoring wells (six total) for analysis via US EPA Method 8021B for VOCs and via US EPA Method 8015 for TPH, diesel range organics (DRO). Five of these six samples were submitted for laboratory analyses; product was observed in MW-4 and a sample from that well was not submitted for laboratory analyses.
- Preparation of this summary report.

4.0 SITE LOCATION AND DESCRIPTION

SITE Owner:	Canadian Pacific Railroad
AST Owner:	Fred W. Lewis Oil Co.
Lot Size:	Approximately 1.2 acres
Latitude:	44°55'19.18" North
Longitude:	73°06'37.68" West
Zoning:	Commercial/Industrial
Utilities:	<u>Water and Sewer</u> – Public (no facilities service SITE) <u>Electric</u> - Overhead connection. <u>Telephone</u> - None on SITE
Structures:	Electrical/Storage shed in the south portion of the SITE; loading rack
Petroleum	No. 2 Fuel Oil
Equipment:	see sections 4.2.1 and 4.2.2

The SITE is located on the north side of Bay Street on the east end of St. Johnsbury, Vermont (see SITE Location Map, **Figure 1**).

4.1 Operations and Products

The facility is an on-shore bulk petroleum storage facility engaged in the distribution of #2 fuel oil and kerosene (see Facility Plan, **Figure 2**). Yearly throughput is estimated at 1.3 million gallons per year.

4.2 Outdoor Bulk Storage Tanks

Out of Service and Removed Tanks

Tank 1: 15,000-gal capacity (**out-of-service**), horizontal, above ground welded steel tank formerly used to store #2 fuel oil. The tank rests on a steel cradle with concrete footings. The tank is manifolded with **Tanks 2 & 3**. Venting is adequate. Age of the tank is unknown.

Tank 2: 15,000-gal capacity (**out-of-service**), horizontal, above ground welded steel tank formerly used to store #2 fuel oil. The tank rests on a small steel cradle on a concrete footing that is shared with

Tank 3: The tank is manifolded with Tanks 1 & 3. Venting is adequate. Age of the tank is unknown.

Tank 3: 15,000-gal capacity (**removed from site**), horizontal, above ground welded/riveted steel tank formerly used to store #2 fuel oil. The tank formally rested on a small steel cradle on a shared concrete footing with Tank #2. The tank was manifolded with Tanks 1 & 2.

Tank 4: 10,000-gal capacity (**out-of-service**), horizontal, above ground welded steel tank formerly used to store kerosene. The tank rests on a small steel cradle that rests on two concrete forms. Venting is adequate. Age of the tank is unknown.

Tank 5: 15,000-gal capacity (**out of service**), horizontal, above ground welded steel tank formally used to store kerosene. The tank rests on a small steel cradle that rests on two concrete forms. Venting is adequate. Age of tank is unknown.

Tank 6: 10,000-gal capacity (**out-of-service**), horizontal, above ground welded steel tank formerly used to store kerosene. The tank rests on two concrete forms. Venting is adequate. Age is unknown.

In Service Tanks

Tank 7: 19,000-gal capacity (**in service**), horizontal, above ground welded/riveted steel tank used to store #2 fuel oil. The tank is manifolded with Tanks 8 & 9 and rests on a steel cradle that rests on concrete footings. Venting is adequate. Age is unknown.

Tank 8: 19,000-gal capacity (**in service**), horizontal, above ground welded/riveted steel tank used to store #2 fuel oil. The tank is manifolded with Tanks 7 & 9 and rests on a steel cradle that rests on concrete footings. Venting is adequate. Age is unknown.

Tank 9: 19,000-gal capacity (**in service**), horizontal, above ground welded/riveted steel tank used to store #2 fuel oil. The tank is manifolded with Tanks 7 & 8 and rests on a steel cradle that rests on concrete footings. Venting is adequate. Age is unknown.

Tank 10: 19,000-gal capacity (**in service**), horizontal, above ground welded/riveted steel tank formerly used to store #2 fuel oil is now used to store kerosene. The tank rests on a steel cradle that rests on concrete footings. The tank is also manifolded with Tanks 7, 8, & 9, but is separated in line by two (2) gate valves that are kept closed. Venting is adequate. Age is unknown.

4.2.1 Products and Quantities Stored at the Facility

Petroleum products that are currently stored at this facility include:

Product	Quantity (gal)
#2 fuel oil	57,000
kerosene	19,000

4.3 Unloading/Loading Facilities

Bulk products are received at the physical plant by an 11,700-gal transport truck, and transferred to **Tank 7, 8, 9, & 10** by pumping equipment and pipelines permanently installed at the plant. Hoses are used to connect the transport truck to the fill pipelines. Two (2) transfer pumps are used to draw product from the transport truck to fill the appropriate tanks. One pump is used to fill **Tanks 7, 8 & 9** and one pump is used to fill **Tank 10**.

Gate valves are opened as necessary to allow the pump to draw from the transport truck to fill the appropriate tanks. When transfer is complete, valves are closed, and hoses are uncoupled. At no time is the product transfer left unattended.

Loading of products from outdoor bulk storage to delivery trucks is accomplished by reversing the feed to the in-line pumping equipment. Top loading is utilized and the loading arm is positioned into the tank manhole before the pump is engaged to load the truck. No hoses are used at the loading platform. When loading is complete, valves and power are shut down and secured. At no time is the loading operation left unattended.

4.4 On-Site Buildings

A small wooden shed is located at the bulk facility and is used to enclose the master power control panel and store spill prevention supplies.

5.0 REGIONAL SURVEY

Development near the SITE is a mix of commercial, industrial, and undeveloped land. To the west of the site is the Canadian Pacific Railway. Several rail spurs run north/south to the west. The land slopes down sharply from the railroad spurs and the bulk storage tanks. Previously this allowed for gravity off-loading from the rail cars to the AGSTs. To the north is a narrow strip of land between the rail road and Bay Street. This land is heavily vegetated with small saplings. Directly to the east is Bay Street and Northern Petroleum's Bulk storage facility. Northern Petroleum's storage facility includes several vertical bulk storage tanks and a warehouse building on slab. To the south is a small triangular shaped parcel that is undeveloped.

Other than the Lewis Oil SITE (SMS Site #98-2484) there are numerous facilities listed on the active hazardous waste site list with the VT SMS that have had releases of oil or hazardous material are located in the SITE vicinity. These are the following:

Windshield World	SMS Site # 931549
Former Ralston Purina Plant	SMS Site # 951844
Carlet, Gilson & Harley	SMS Site # 972187
Northern Petroleum	SMS Site # 971169
Canadian National Railway	SMS Site # 982356

There are several potential sites located on Railroad Street hydraulically up gradient of the Lewis Oil site. These include the current Irving gas station, the current Mobil gas station, the former auto repair and paint shop, the former Atlantic gas station and an unnamed former gas station on the corner of Cross and Railroad streets. The Tewhey report also identified seven USTs and AGSTs on the rail yard property that are either active, abandoned or have been removed from service.

6.0 SUBSURFACE INVESTIGATION

A subsurface exploration program was developed to gather data to further assess petroleum-related contamination in the soils and groundwater on SITE.

6.1 Advancement of Soil Borings

A total of ten (10) soil borings were advanced by TSEC in locations indicated on **Figure 2** using TSEC's Geoprobe[®]. Logs for these borings are presented in **Appendix B**. Nine of the ten borings were advanced to twelve feet below ground surface (bgs); the remaining boring was advanced to eight feet bgs. All borings were logged describing soil strata conditions, and field screened for VOCs with a PID using conventional headspace techniques (described further in **Section 7.1 – Field Screening Results**).

- Soil Boring **B-101** was advanced in the approximate center of the loading yard southwest of the loading rack to characterize SITE conditions in the delivery truck loading area. During advancement of this boring, groundwater was encountered at a depth of approximately 3.5 ft bgs. This boring was completed to a depth of 12.0 ft bgs, and backfilled with drill cuttings, bentonite, and sand to grade.
- Soil Boring **B-102** was completed west and north of B-101 at the west edge of the roadway closer to the Railway tracks. This boring, completed to a depth of 12.0 ft bgs, was also backfilled.
- Soil Boring **B-103** was advanced near the northern extent of the SITE. The location chosen is just north of a 3 foot high earthen berm. The berm was constructed to contain any spills SITE. This boring was advanced to a total depth of 12.0 ft bgs. TSEC's on-site representative logging the soils reported a significant "gasoline odor."
- Soil Boring **B-104** was advanced just to the northeast of the loading rack. Like B-101 this boring was in the loading yard. This boring, advanced to 12.0 ft bgs, was backfilled. Depth to groundwater at the time of drilling was approximately 4.0 ft bgs.
- Soil Boring **B-105** was advanced on the east side of Bay Street opposite the loading rack. The bulk storage facility is on the west side of Bay Street. Based on the assumed groundwater flow direction this location was thought to be down gradient of the SITE. Groundwater was encountered at approximately 3.5 ft bgs during installation. This boring, completed to a depth of 12.0 ft bgs, was completed as monitoring well **MW-1**.
- Soil Boring **B-106** was also advanced on the east side of Bay Street opposite north end of the the ASTs. Groundwater was encountered at approximately 4.7 ft bgs during installation. This boring, completed to a depth of 12.0 ft bgs, was completed as monitoring well **MW-2**. Gasoline odors were also identified during the field investigation at this boring location.

- Soil Borings B-107 was advanced within the concrete retaining wall at the north end of the AST storage area. This boring, advanced to a depth of 8.0 ft, was also backfilled.
- Soil Boring B-108 was advanced at the southern end of the concrete retaining wall, just north of B-102. This boring, drilled to a depth of 12.0 ft bgs, was completed as monitoring well MW-3.
- Soil Boring B-109 was advanced just to the southeast of the loading rack. Like B-101 this boring was in the delivery roadway. This boring was drilled to a depth of 12.0 ft bgs, and was completed as monitoring well MW-4. Groundwater was encountered at a depth of 4.7 ft bgs.
- Soil Boring B-110 was advanced near the electrical control building on the southern portion of the SITE. This location was chosen as a down gradient location from monitoring well MW-4. This boring, completed to a depth of 12.0 ft bgs, was backfilled.

General soil conditions encountered at the SITE consisted of a fine sand changing to medium sand and gravel at deeper depths. Groundwater was encountered during drilling at depths ranging from 3.5 ft bgs to just over 4.5 feet bgs.

Further description of subsurface materials and contaminant distribution can be found in **Appendix B, Boring Logs** ↓

6.2 Monitoring Well Installation and Construction

All monitoring wells were completed by installing a 1 ½ -inch diameter schedule 40 polyvinylchloride (PVC) monitoring well with 10 ft of 0.010-inch machine slotted screen. The annular space between the well screen and the borehole wall was filled by a clean sand filter pack. A 1 ½ -inch diameter PVC riser was placed above the screen, and a bentonite seal was placed around the riser to prevent surface infiltration. Wells were completed with a flush-mounted, water-tight curb box that was set in concrete, and fitted with an expansion plug to avoid surface infiltration to the aquifer.

Following installation of the new monitoring wells, each monitoring well was developed using a peristaltic pump to remove fine particulates introduced into the formation during drilling and/or installation. Well development was also performed to hydraulically connect the aquifer and the well, allowing for more accurate determination of *in situ* conditions (i.e. water level, aquifer parameters, and chemical constituents). A minimum of three (3) well volumes of water was removed from each well, until the purge water was clear. Development water was discharged directly to the ground surface.

Further details of the well installations are presented in **Appendix B—Monitoring Well Logs**.

6.3 SITE Geology

A summary of the geological units encountered during drilling activities indicated that the native materials consist of fine to medium sands with some silt overlying a 1 ½ to 2 ft thick layer of coarse sand and gravel. This coarse sand and gravel zone was consistently encountered at approximately 10 ft bgs. Most borings were terminated at 12 ft bgs therefore, the extent of the gravel zone is not fully known.

Bedrock was not encountered during this investigation. For a more detailed description of geological units, see Boring Logs, **Appendix B**.

Surficial geologic materials that underlie the SITE consist of Littoral sediment predominately gravel¹. Reports available concerning the bedrock materials underlying the SITE are limited, however, one report indicated that materials present consist of limestone².

6.4 SITE Survey

A Topcon AT-G6 auto level was used to perform a stadia survey to identify the location and relative elevations of key SITE features. The collected data was used to update the SITE Plan (**Figure 2**) and obtain top of PVC riser elevations necessary to calculate water table elevations.

¹ Doll, C.G., editor, 1970, Surficial Geologic Map of Vermont, VT Geological Survey, SGL.

² Hall, L.M., 1959, The Geology of the St. Johnsbury Quadrangle, Vermont and New Hampshire: Vermont Geol. Survey, Bulletin No. 13.

7.0 SOIL SAMPLING ACTIVITIES

7.1 Field Screening Results

Soil samples were field screened using conventional headspace methods. A Thermo Environmental Instruments Model 580B Organic Vapor Meter with a 10.6 eV photoionization detector (PID) was employed to detect the presence of VOCs. The PID was calibrated to a 95 ppmv isobutylene standard, referenced to benzene. Data collected during the field screening indicates elevated levels of VOCs within the subsurface soils.

Soils with PID readings greater than 0.1 ppmv were encountered in all borings except **B-101**, **B-105**, and **B-110**. **B-101** and **B-110** are adjacent and located furthest to the south on the SITE. PID readings for **B-105**, located across Bay Street northeast of **B-110**, also had PID reading less than 0.1 ppmv in the 0-4 foot sample; there was no recovery of soils at deeper depths in **B-105**. PID data for **B-108** was lost. A headspace PID analysis performed on the samples collected from the remaining six borings indicated VOCs present at concentrations ranging from 0.2 ppmv (8-12 ft bgs in **B-102**) to 534 ppmv (0-4 ft bgs in **B-103**). Olfactory observations indicate a distinct gasoline odor from borings **B-103** and **B-106**.

7.2 Laboratory Results

No soil samples were collected for laboratory analysis during this investigation.

8.0 GROUNDWATER SAMPLING ACTIVITIES

On April 21, 1999 TSEC collected groundwater elevation and groundwater samples from all accessible monitoring wells for laboratory analysis via US EPA Method 8021B for VOCs and via US EPA Method 8015 for total petroleum hydrocarbons (TPH) as diesel range organics (DRO). Endyne, Inc. of Williston, VT (Endyne) conducted all laboratory analyses for this project. Five of these six samples were submitted for laboratory analyses; 2.04 inches of product was observed in MW-4 and, consequently, no samples were submitted for laboratory analyses for MW-4.

8.1 Water Table Elevation and SITE Hydrogeology

8.1.1 Water Table Elevation – April 21, 1999

On April 21, 1999, all five (5) groundwater monitoring wells were accessed for fluid level measurements. Depth to groundwater in the five (5) monitoring wells was measured between 2.32 ft bgs (MW-8) and 5.28 ft bgs (MW-1). A full analysis of groundwater elevation data is presented in **Table 1, Summary of Groundwater Elevations – April 21, 1999.**

8.1.2 SITE Hydrogeology

A groundwater contour plan with the inferred groundwater flow direction has been prepared from the April 21, 1999 groundwater elevation data and is presented as **Figure 3.** The groundwater was calculated to be flowing to the southeast with a horizontal gradient of about $0.0042 \text{ }^{\text{ft}}/\text{ft}$ between MW-3 and MW-4, a horizontal gradient of about $0.0017 \text{ }^{\text{ft}}/\text{ft}$ between GP-5 and MW-1, and a horizontal gradient of about $0.0021 \text{ }^{\text{ft}}/\text{ft}$ between GP-4 and MW-2. A SITE horizontal average of $0.0027 \text{ }^{\text{ft}}/\text{ft}$ was estimated based on these three (3) measured gradients.

Based on the average measured horizontal hydraulic gradient (i) of 0.0027 ft/ft , the published hydraulic conductivity (k) for well sorted sand of 2.8 feet per day (ft/d) to 283 ft/d (Fetter³), and the assumed porosity value of 30% for this SITE (η), the apparent groundwater flow velocity beneath the SITE can be calculated using the following equation:

$$\text{Equation: } V_{gw} = \frac{ki}{\eta}$$

The calculated apparent groundwater velocity of the water bearing fine sand zone, according to the above equation, ranges from 0.025 ft/d to 2.55 ft/d (9.3 ft/yr to 930 ft/yr). It is likely that the groundwater velocity within the coarse sands and gravel zone identified between 10 and 12 ft bgs is much faster.

³ Fetter, C.W., 1994, Applied Hydrogeology – 3rd Edition. Englewood Cliffs, NJ: Prentice Hall. 691p.

8.2 Groundwater Sampling Activities

Prior to collecting samples, each well was purged of three (3) standing volumes of water to obtain a representative sample from the surrounding aquifer. Purge water from all wells was discharged directly to the ground surface. A "soakease" petroleum absorbent sock has been placed in monitoring well MW-4.

8.3 Groundwater Analytical Results

Results received from Endyne indicate that petroleum compounds are present in all five (5) of the groundwater monitoring wells sampled, Table 2.

The laboratory initially analyzed the samples by EPA Method 602 in error. The laboratory indicated that the error was in reporting and would resubmit the data in the EPA Method 8021B format to include the requested parameter list. Apparently, the laboratory re-analyzed the samples via EPA Method 82021B. The latter data is discussed herein, however it should be noted that the relative percent difference RPD of specific compounds is as much as is 67 % which is typically considered invalid.

The laboratory also analyzed the samples for TPH by Method 8015 DRO instead of Method 8100 as requested. Although these methods are similar the comparison of results to earlier 8100 TPH data from the November 1998 sampling of wells GP-4 and GP-5 is questionable.

8.3.1 Volatile Organic Compounds

The maximum total dissolved levels of benzene, toluene, ethylbenzene, and total xylenes (BTEX) was detected in monitoring well GP-4 at 3,038 micrograms per liter ($\mu\text{g/l}$). Concentrations of total BTEX were also reported in MW-1 ($7.0\mu\text{g/l}$), MW-2 ($243\mu\text{g/l}$), MW-3 ($1.3\mu\text{g/l}$), and GP-5 ($94\mu\text{g/l}$).

Trimethylbenzene isomers were detected above their respective method detection limits (MDLs) in all monitoring wells except for MW-3. Naphthalene was detected above its MDL in all monitoring wells except for MW-1.

The MDL for MTBE was raised above VGES (Vermont Groundwater Enforcement Standard) due to sample dilution at the laboratory in samples collected from monitoring wells MW-2, GP-4 and GP-5. In MW-1 and MW-3, MTBE was not detected at $10\mu\text{g/l}$ which is less than the VGES.

VOCs were detected at concentrations exceeding Vermont Groundwater Enforcement Standards (VGES) in groundwater monitoring wells MW-2, GP-4, and GP-5.

8.3.2 Total Petroleum Hydrocarbons

Samples from monitoring wells were analyzed for TPH as fuel oil via US EPA Method 8015 DRO. Data from these analyses indicate that TPH as fuel oil is present above the MDL of 400 µg/l in MW-2 (5,660 µg/l), GP-4 (55,600 µg/l), and GP-5 (455,000 µg/l).
5660 ppm 55600 ppm 455000 ppm

The State of Vermont does not currently impose a VGES for TPH in groundwater.

8.3.3 BTEX distribution in Groundwater

BTEX results and a preliminary isopleth plan have been presented as **Figure 4**. There appears to be some indication that free product observed in MW-4 may be related to loading/unloading activities at the transport truck unloading rack since the sample from MW-3, which is up gradient from MW-4 and down gradient from, did not indicate BTEX compounds at the method detection levels. Also, GP-5 had total BTEX compounds measured at 94 µg/l but further to the north in GP-4, BTEX compounds totaled 3,038 µg/l. This indicates a lower BTEX compound total between GP-4 and MW-4 suggesting two separate plumes: one originating near the transport truck unloading rack, and one further north near the ASTs. Also, the detection of benzene was found in the northern most monitoring wells GP-4 and MW-2 when considering the EPA Method 602 data discussed above.

With regard to the free product observed at MW-4, there are no down gradient monitoring wells presented here to evaluate the extent of this distribution in the groundwater. Boring B-110 was installed down gradient of MW-4 and did not show the presence of petroleum compounds in the soil. And, with regard to the second distribution of BTEX near the ASTs, there are no on-SITE monitoring wells up gradient of GP-4 for a complete evaluation of this plume either. Data from off-SITE wells both southeast and northwest of the SITE are necessary to assess the distribution of BTEX compounds in groundwater.

8.4 QA/QC RESULTS

8.4.1 Field QA/QC

The Relative Percent Difference (RPD) for total aromatics (BTEX, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, and naphthalene) in the sample collected from MW-2 and its duplicate, DUP-1 was calculated to be 7.9 %. Typically, a RPD of up to 25% is considered to be an acceptable correlation between duplicate samples.

BTEX and MTBE were not detected above method detection limits in the Field Blank.

8.4.2 Laboratory QA/QC

All laboratory data was evaluated for the following parameters prior to acceptance in this report:

- analysis within method specified holding time;
- correct sample ID's;
- acceptable detection limit multipliers;
- acceptable matrix spike (MS) and matrix spike duplicate (MSD) recoveries;
- acceptable Relative Percent Difference between MS and MSD; and,
- acceptable surrogate recoveries where applicable.

9.0 CONTAMINATED SOILS MANAGEMENT

No contaminated soils are stockpiled on SITE.

10.0 POTENTIAL RECEPTORS

During this and previous investigations, a sensitive receptor evaluation was conducted in the immediate vicinity. This investigation focused on surface water receptors, breathing zones, groundwater supplies in the immediate vicinity, down gradient residential and commercial basements, and area subsurface utilities.

The nearest surface water receptor identified is the Passumpsic River to the east. A visual reconnaissance was performed along the SITE boundary in an attempt to identify locations of distressed vegetation. No apparent observations were identified. Various buildings including the Northern Petroleum building and the automotive repair building located southeast of the Lewis Oil Co. site both utilize petroleum products and based on visual observations are probably not pristine.

11.0 CONCEPTUAL HYDROGEOLOGICAL MODEL

Groundwater at the SITE is contained primarily within a zone of well graded sands beginning at a depth of approximately 3.5 ft bgs and extends down to the previously mentioned gravel zone to about 11 ft bgs. The lower extent of the gravel zone was not defined during this investigation.

The SITE topography is flat with an extremely steep rise to the Railway tracks west of the SITE. The local surface water drainage patterns are controlled by made man features on SITE to divert flow south and north. During spring thaw runoff is evident from the rail road tracks down the embankment towards the AST containment area.

Within the monitoring well network, groundwater flows to the southeast, with an average horizontal hydraulic gradient of 0.0027 ft/ft as calculated from measurements on April 21, 1999., see Section 8.1. Also, as calculated in Section 8.1, the average groundwater velocity beneath the SITE ranges from 0.025 ft/d to 2.55 ft/d (9.3 ft/yr to 930 ft/yr.).

Based on the equation below, the contaminant of concern (V_{coc}) transport velocities can be calculated.

$$\text{Equation: } V_{coc} = \frac{V_{gw}}{R},$$

where R is a site specific retardation factor calculated for the contaminants of concern (for Benzene $R=1.6$, for o-xylene $R=3.9$).

The contaminant transport velocity values presented below are based on a retardation factor (R) calculated from published sources (see Note 1). Values may vary, depending on site specific values of the fraction of organic carbon (f_{oc}), the soil bulk density (ρ_s), and the formation porosity (η). For these calculations, f_{oc} was estimated at 0.002 g/g , ρ_s was estimated to be 1.8 g/cm^3 , and η was estimated to be 30%.

TABLE – Estimation of Contaminant Transport Velocities

Subsurface Materials	Water Table Gradient (ft/ft)	k (ft/day)	V_{gw} (ft/day)	$V_{benzene}$ (ft/day)	$V_{o-xylene}$ (ft/day)
graded sands (low est)	0.0027	2.8	0.025	0.016	0.006
graded sands (high est)	0.0027	283	2.55	1.6	0.65

Notes:

1. Parameter values used to estimate contaminant transport velocities were obtained from risk-based corrective action look-up tables in ASTM E1739, "Standard Guide for Risk Based Corrective Action Applied at Petroleum Release Sites" and the Illinois Environmental Protection Agency Bureau of Land "Tiered Approach to Cleanup Objectives Guidance Document."
2. Porosity values were estimated as follows: Silty Sands=30%.

Based on these calculations, a molecule of groundwater flows through the monitoring well network (from GP-5 to MW-1, 92 feet apart) from 1 month to 10 years depending on SITE specific characteristics for the hydraulic conductivity.

Surface water flows off-SITE to the south and north, ultimately discharging to the Passumpsic River, approximately 0.1 mile east of the SITE.

Petroleum compounds discovered in the soil and groundwater are most likely attributed to spills, drips, and overfills from activities related to the bulk petroleum storage facility ASTs. The levels of contaminants detected in soil and groundwater are modest, but it does not appear as though any of the receptors identified during this investigation, other than the surface water drainage bordering the SITE to the south, have been impacted by the release of petroleum at Lewis Oil.

12.0 CONCLUSIONS

Based on the investigation conducted at this SITE, and the data obtained, TSEC provides the following conclusions regarding this SITE:

- TSEC completed a subsurface investigation program that included the advancement of ten (10) soil borings and the installation of four (4) groundwater monitoring wells between March 20-21, 1999. Groundwater samples collected on April 21, 1999 indicate that petroleum contamination has migrated to the southeast SITE boundary.
- Soils with PID readings greater than 0.1 ppmv were encountered in all borings except **B-101**, **B-105**, and **B-110** (PID data for **B-108** was lost). A headspace PID analysis performed on the samples collected from the remaining six borings indicated VOCs present at concentrations ranging from 0.2 ppmv (8-12 ft bgs in **B-102**) to 534 ppmv (0-4 ft bgs in **B-103**).
- Benzene contamination was present above its VGES level of 5 µg/l in the samples collected from MW-2 (31.6 µg/l). Due to laboratory sample dilution, the MDLs were raised above VGES in samples collected from GP-4 and GP-5 to 20 and 10 ug/l, respectively.
- Trimethylbenzene isomers and/or naphthalene were detected above their respective VGES in three of the five wells sampled: MW-2, GP-4 and GP-5.
- Separate phase petroleum product was observed in MW-4 during the sampling event on April 21, 1999.
- There appears to be some indication that free product observed in MW-4 may be related to loading/unloading activities at the transport truck unloading rack since the sample from MW-3, which is up gradient from MW-4, did not indicated BTEX compounds at the method detection levels. Also, GP-5 had total BTEX compounds measured at 94 ug/l, but further to the north in GP-4 BTEX compounds totaled 3,038 ug/l. This indicates a lower BTEX compound total exists between GP-4 and MW-4, suggesting two separate plumes: one originating near the transport truck unloading rack, and one further north near the ASTs.
- With regard to the free product observed at MW-4, there are no down gradient monitoring wells presented here to evaluate the extent of this distribution in the groundwater however, a soil boring (B-110) installed just down gradient on the property did not show positive PID readings of soil samples above 0.1 ppmv.
- With regard to the second distribution of BTEX near the north end ASTs, there are no on-SITE monitoring wells up gradient of GP-4 for a complete evaluation of this plume either.

Lewis Oil
St. Johnsbury, Vermont
June 18, 1999

- Data from off-SITE wells both southeast and northwest of the SITE are necessary to assess the distribution of BTEX compounds in groundwater.

13.0 RECOMMENDATIONS

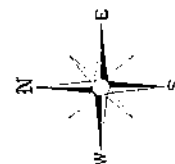
Based on the information available to date concerning this SITE and vicinity, TSEC offers the following recommendations:

TSEC recommends the continued use of "soak-ease" in monitoring well MW-4.

TSEC recommends that results of this study be evaluated with results of environmental site assessments on adjacent properties and also, in consideration of the historical use of the SITE and of adjacent properties, before additional investigations, monitoring or remediation plans are proposed. This SITE, from a geological perspective, is a very small portion of a much larger geological formation that has historical been under stress due to past uses.

\\FS1\PROJECT\98-112sm\0599sir.doc

FIGURES



0 2000
Scale
(in feet)
1"=2,000'

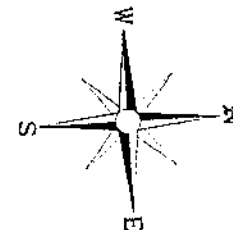
Source: USGS 7.5 Minute Topographic Series
St. Johnsbury and Concord, Vermont Quadrangles

Project No.
98-112

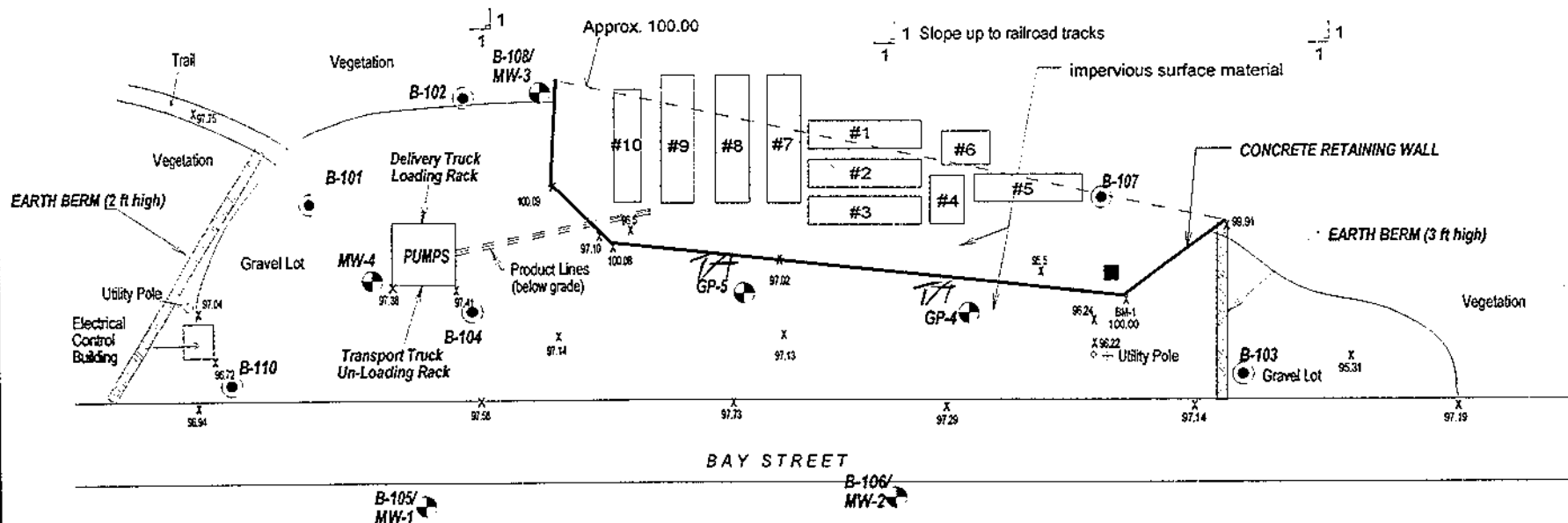
Designed By: jpb
Checked By: jpb
Approved By: jpb
Drawn By: as shown
Scale: as shown
Date: 06/17/99

TWIN STATE ENVIRONMENTAL CORP.
34 Roosevelt Highway
Colchester, Vermont 05446
(802) 654-8653

FIGURE 1
SITE LOCATION MAP
Fred Lewis Oil Company, Inc.
St. Johnsbury, Vermont



Canadian Pacific Rail Road



LEGEND

B-101
● Location of Geoprobe Soil Boring

B-105/
MW-1 ● Location of Groundwater Monitoring Well

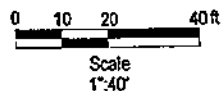
ON-SITE STORAGE TANKS

- 1* 15,000-gal #2- fuel oil AGST
- 2* 15,000-gal #2- fuel oil AGST
- 3* 15,000-gal #2- fuel oil AGST
- 4* 10,000-gal #2- kerosene AGST
- 5 15,000-gal #2- kerosene AGST
- 6* 10,000-gal #2- fuel oil AGST
- 7 19,000-gal #2- fuel oil AGST
- 8 19,000-gal #2- fuel oil AGST
- 9 19,000-gal #2- fuel oil AGST
- 10* 15,000-gal #2- fuel oil AGST

* - Tanks not in use.

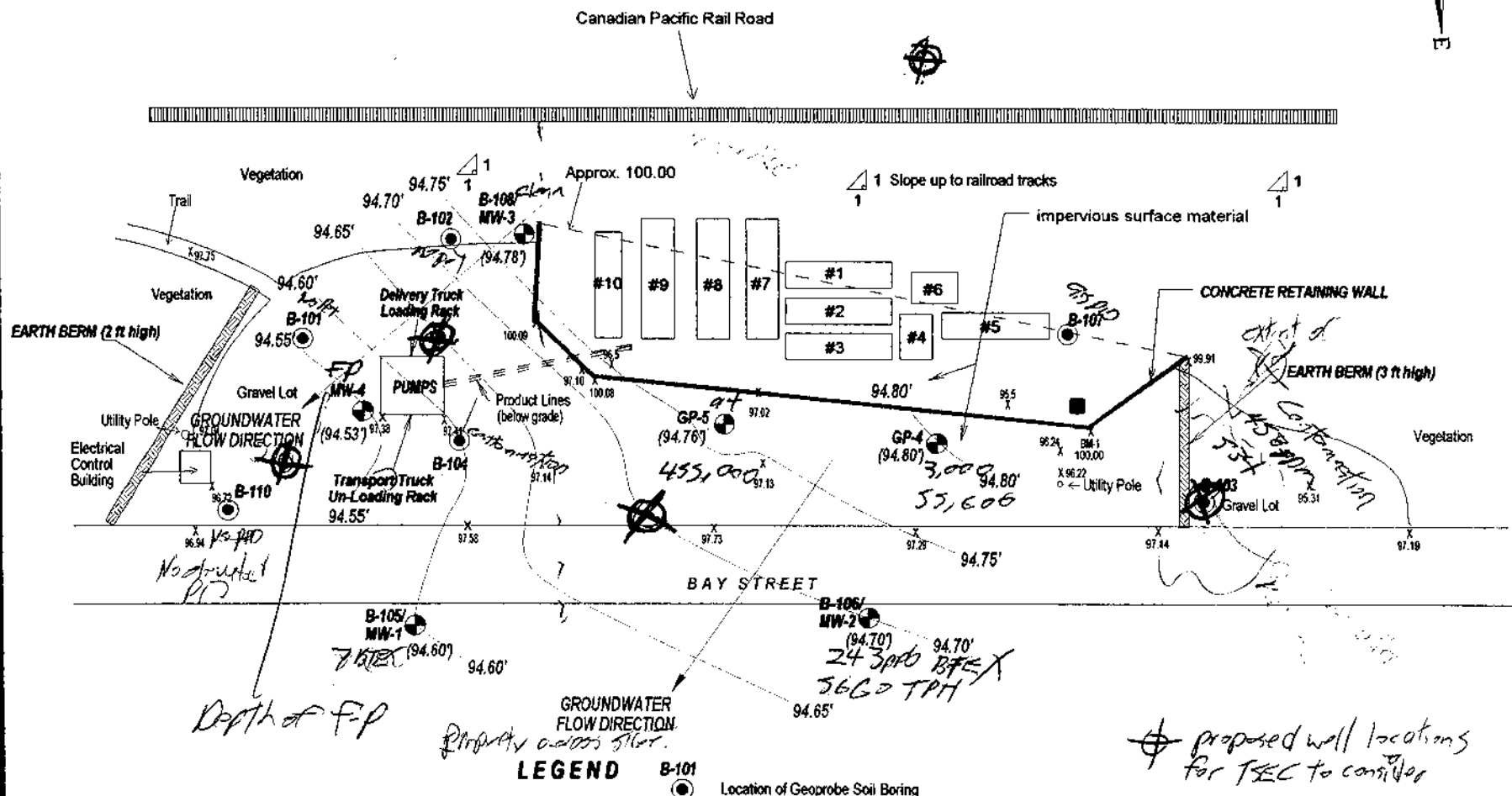
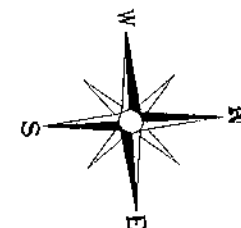
AGST - above ground storage tank

00.00 Surface grade elevation based on a temporary benchmark of 100.00



kjb:\project\94150\conpln.skd

Project No: 98-112	Designed By: kjb	TWIN STATE ENVIRONMENTAL CORP. 34 Roosevelt Highway Colchester, Vermont 05446 (802) 654-8663	FIGURE 2 SITE Plan Fred Lewis Oil Co., Inc. St. Johnsbury, VT
	Checked By: jrd		
	Approved By: jrd		
	Drawn By: jpb		
	Scale: 1"=40'		
Date: 06/17/99			



TABLES

TABLE 1

LEWIS OIL CO.
ST. JOHNSBURY, VERMONT
SMS SITE #98-2484

Summary of Groundwater Elevations

April 21, 1999

Well Identification	Top of Riser Elevation	Depth to Product	Depth to Water	Depth of Well	Thickness of Water in Well	Water Table Elev.
MW-1	98.42	ND	3.82	9.90	6.08	94.60
MW-2	99.43	ND	4.73	10.85	6.12	94.70
MW-3	100.05	ND	5.27	11.35	6.08	94.78
MW-4	99.14	4.57	4.74	10.40	5.66	94.53
GP-4	98.62	ND	3.82	11.90	8.08	94.80
GP-5	98.81	ND	4.05	11.40	7.35	94.76

- Notes:
1. Elevation data is referenced to a TBM. Units are in feet.
 2. ND - not detected.
 3. NA - not applicable.
 4. Measurements recorded are referenced to a marking on top of PVC riser for each well.
 5. Depth to fluid measurements were obtained using a Solinst Interface Probe.
 6. MW-4 water table elevation data corrected for presence of free product.

m:\project\98112\report tables.xls\water table elevations-0499

TABLE 2

Lewis Oil
St. Johnsbury, VERMONT
SMS SITE#98-2484

Summary of Water Quality

4/21/1999 & 11/25/98

Compound	Benzene	Toluene	Ethyl- benzene	Total Xylenes	Total BTEX	MTBE	1,3,5- Trimethylbenzene	1,2,4- Trimethylbenzene	Naphthalene	TPH 8015DRO	TPH 8100
Sample ID	Concentration (µg/l)										
MW-1	<1	<1	1.4	5.6	7.0	<10	1.3	3	<1	<400	NA
MW-2	31.6	tbq<5	48.3	163	243	<50	37.9	80	7.5	5,660	NA
MW-3	tbq<1	<1	tbq<1	1.3	1	<10	<1	<1	3.4	<400	NA
MW-4	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	NA
GP-4, 11/25/98	ND	ND	435	1,930	2,365	<200	NA	NA	NA	NA	6,530
GP-4	tbq<20	26.5	541	2,470	3,038	<200	280	860	378	55,600	NA
GP-5 11/25/98	ND	ND	ND	ND	<50	<20	NA	NA	NA	NA	522,000
GP-5	<10	<10	12.2	81.9	94	<100	85.1	168.0	176	455,000	NA
DUP-1 ⁽⁴⁾	32.3	tbq<5	55.1	169	256	<50	41.2	89.4	12.4	6,700	6,700
Field Blank	<1	<1	<1	<1	—	<10	<1	<1	<1	<400	<400
VGES ⁽¹⁾	5.0	1,000	700	10,000	ne	40	4.0	5.0	20	ne	ne

Notes:

1. VGES -Vermont Groundwater Enforcement Standard.
2. ne -VGES not established.
3. **Bold and italic** numbers indicate concentrations that exceed VGES.
4. DUP-1 - Duplicate sample of monitoring well MW-2. Collected for Quality Assurance/Quality Control.
5. All samples collected on 4/21/99 were analyzed for VOCs via US EPA Method 8021B.
6. Samples collected from MW-1 through GP-5 on 4/21/99 were analyses for TPH as fuel oil via US EPA Method 8015M-DRO.
7. MS-4 no sample (ns) due to product observed in well.
8. NA Not analyzed

jpb:\project\98112\chem_lewis.xls\groundwater quality-0599

APPENDIX A



ENDYNE, INC.

Laboratory Services

32 James Brown Drive
Williston, Vermont 05495
(802) 879-4333
FAX 879-7103

MAY 13 1999

REPORT OF LABORATORY ANALYSIS

CLIENT: Twin State Environmental Corp.

ORDER ID: 2060

PROJECT NAME: Lewis Oil/#98112

REF.#: 137,289 - 137,295

REPORT DATE: May 7, 1999

DATE SAMPLED: April 21, 1999

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. Chain of custody indicated sample preservation with HCl.

All samples were prepared and analyzed by requirements outlined in the referenced method and within the specified holding times. All instrumentation was calibrated with the appropriate frequency and verified by the requirements outlined in the referenced method. Blank contamination was not observed at levels affecting the analytical results.

Analytical method precision and accuracy was monitored by laboratory control standards which included matrix spike, duplicate and quality control analyses. These standards were determined to be within established laboratory method acceptance limits.

Individual sample performance was monitored by the addition of surrogate analytes to each sample. All surrogate recovery data was determined to be within laboratory QA/QC guidelines unless otherwise noted.

Reviewed by,

Harry B. Locker, Ph.D.
Laboratory Director

enclosures

**ENDYNE, INC.****Laboratory Services**

32 James Brown Drive
Williston, Vermont 05495
(802) 879-4333
FAX 879-7103

EPA METHOD 8021B--PURGEABLE AROMATICS

CLIENT: Twin State Environmental Corp.

DATE RECEIVED: April 21, 1999

PROJECT NAME: Lewis Oil/#98112

REPORT DATE: May 7, 1999

CLIENT PROJ. #: 98112

ORDER ID: 2060

Ref. #:	137,289	137,290	137,291	137,292	137,293
Site:	MW-1	MW-2	MW-3	GP-4	GP-5
Date Sampled:	4/21/99	4/21/99	4/21/99	4/21/99	4/21/99
Time Sampled:	11:49	12:01	12:30	12:13	12:20
Sampler:	BW	BW	BW	BW	BW
Date Analyzed:	4/27/99	4/27/99	4/27/99	5/3/99	5/3/99
UIP Count:	>10	>10	3	>10	>10
Dil. Factor (%):	100	20	100	5	10
Surr % Rec. (%):	90	78	95	87	102
Parameter	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)
MTBE	<10	<50	<10	<200	<100
Benzene	<1	31.6	TBQ <1	TBQ <20	<10
Toluene	<1	TBQ <5	<1	26.5	<10
Ethylbenzene	1.4	48.3	TBQ <1	541.	12.2
Xylenes	5.6	163.	1.3	2,470.	81.9
1,3,5 Trimethyl Benzene	1.3	37.9	<1	280.	85.1
1,2,4 Trimethyl Benzene	2.6	80.4	<1	860.	168.
Naphthalene	<1	7.5	3.4	378.	176.

Ref. #:	137,294	137,295			
Site:	Dup-1	F.B.			
Date Sampled:	4/21/99	4/21/99			
Time Sampled:	12:16	11:35			
Sampler:	BW	BW			
Date Analyzed:	4/27/99	4/27/99			
UIP Count:	>10	0			
Dil. Factor (%):	20	100			
Surr % Rec. (%):	78	108			
Parameter	Conc. (ug/L)	Conc. (ug/L)			
MTBE	<50	<10			
Benzene	32.3	<1			
Toluene	TBQ <5	<1			
Ethylbenzene	55.1	<1			
Xylenes	169.	<1			
1,3,5 Trimethyl Benzene	41.2	<1			
1,2,4 Trimethyl Benzene	89.4	<1			
Naphthalene	12.4	<1			

Note: UIP = Unidentified Peaks TBQ = Trace Below Quantitation NI = Not Indicated

CHAIN-OF-CUSTODY RECORD

27958

Project Name: LEWIS DIL 98112	Reporting Address: 34 Roosevelt Highway	Billing Address: Same
Site Location: ST. Johnsbury, VT	Colchester, VT 05446	
Endyne Project Number: 2060	Company: TSEL	Sampler Name: BW
	Contact Name/Phone #: 657-8663 Diego	Phone #: Same

[illegible]

Relinquished by: Signature <i>Tom Wagon</i>	Received by: Signature <i>Alison Horner</i>	Date/Time <i>4/21/99 2:10</i>
Relinquished by: Signature	Received by: Signature	Date/Time

New York State Project: Yes No ☒

Requested Analyses

[illegible]

MAY 13 1999



ENDYNE, INC.

Laboratory Services

32 James Brown Drive
Williston, Vermont 05495
(802) 879-4333
FAX 879-7103

LABORATORY REPORT

CLIENT: Twin State Environmental Corp.

ORDER ID: 2060

PROJECT: Lewis Oil///98112

DATE RECEIVED: April 21, 1999

REPORT DATE: May 11, 1999

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. Different groups of analyses may be reported under separate cover.

All samples were prepared and analyzed by requirements outlined in the referenced methods and within the specified holding times.

All instrumentation was calibrated with the appropriate frequency and verified by the requirements outlined in the referenced methods.

Blank contamination was not observed at levels affecting the analytical results.

Analytical method precision and accuracy was monitored by laboratory control standards which included matrix spike, duplicate and quality control analyses. These standards were determined to be within established laboratory method acceptance limits, unless otherwise noted.

Reviewed by,

Harry B. Locker, Ph.D.
Laboratory Director

enclosures

Wrong
method
should be
5/10/99

**LABORATORY REPORT**

CLIENT: Twin State Environmental Corp.

ORDER ID: 2060

PROJECT: Lewis Oil/#98112

DATE RECEIVED: April 21, 1999

REPORT DATE: May 11, 1999

SAMPLER: BW

ANALYST: 820

Ref. Number: 137289 Site: MW-1 Date Sampled: April 21, 1999 Time: 11:49 AM

<u>Parameter</u>	<u>Result</u>	<u>Unit</u>	<u>Method</u>	<u>Analysis Date</u>
TPH 8015 DRO	< 0.40	mg/L	SW 8015B	5/5/99

Ref. Number: 137290 Site: MW-2 Date Sampled: April 21, 1999 Time: 12:01 PM

<u>Parameter</u>	<u>Result</u>	<u>Unit</u>	<u>Method</u>	<u>Analysis Date</u>
TPH 8015 DRO	5.66	mg/L	SW 8015B	5/5/99

Ref. Number: 137291 Site: MW-3 Date Sampled: April 21, 1999 Time: 12:30 PM

<u>Parameter</u>	<u>Result</u>	<u>Unit</u>	<u>Method</u>	<u>Analysis Date</u>
TPH 8015 DRO	< 0.40	mg/L	SW 8015B	5/5/99

Ref. Number: 137292 Site: GP-4 Date Sampled: April 21, 1999 Time: 12:13 PM

<u>Parameter</u>	<u>Result</u>	<u>Unit</u>	<u>Method</u>	<u>Analysis Date</u>
TPH 8015 DRO	55.6	mg/L	SW 8015B	5/6/99

Ref. Number: 137293 Site: GP-5 Date Sampled: April 21, 1999 Time: 12:20 PM

<u>Parameter</u>	<u>Result</u>	<u>Unit</u>	<u>Method</u>	<u>Analysis Date</u>
TPH 8015 DRO	455.	mg/L	SW 8015B	5/9/99



ENDYNE, INC.

Laboratory Services

32 James Brown Drive
Williston, Vermont 05495
(802) 879-4333
FAX 879-7103

Ref. Number: 137294

Site: Dup-1

Date Sampled: April 21, 1999

Time: 12:16 PM

<u>Parameter</u>	<u>Result</u>	<u>Unit</u>	<u>Method</u>	<u>Analysis Date</u>
TPH 8015 DRO	6.70	mg/L	SW 8015B	5/5/99

Ref. Number: 137295

Site: F.B.

Date Sampled: April 21, 1999

Time: 11:35 AM

<u>Parameter</u>	<u>Result</u>	<u>Unit</u>	<u>Method</u>	<u>Analysis Date</u>
TPH 8015 DRO	< 0.40	mg/L	SW 8015B	5/5/99



CHAIN-OF-CUSTODY RECORD

2-c. 1
27958

Project Name: LEWIS OIL 98112	Reporting Address: 34 Roosevelt Highway Colchester, VT 05446	Billing Address: Same
Site Location: St. Johnsbury, VT		
Endyne Project Number: 2060	Company: TSEL Contact Name/Phone #: 657-8663 Jhp Diego	Sampler Name: BW Phone #: Same

[illegible]

Relinquished by: Signature <i>Donna Wager</i>	Received by: Signature <i>Alicia Howard</i>	Date/Time <i>4/21/99 3:10</i>
Relinquished by: Signature	Received by: Signature	Date/Time

New York State Project: Yes No ☒

Requested Analyses

[illegible]



ENDYNE, INC.

Laboratory Services

32 James Brown Drive
Williston, Vermont 05495
(802) 879-4333
FAX 879-7103

REPORT OF LABORATORY ANALYSIS

CLIENT: Twin State Environmental Corp.

ORDER ID: 2060

PROJECT NAME: Lewis Oil/#98112

REF.#: 137,289 - 137,295

REPORT DATE: April 28, 1999

DATE SAMPLED: April 21, 1999

*Wrong
parameter
MS*

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. Chain of custody indicated sample preservation with HCl.

All samples were prepared and analyzed by requirements outlined in the referenced method and within the specified holding times. All instrumentation was calibrated with the appropriate frequency and verified by the requirements outlined in the referenced method. Blank contamination was not observed at levels affecting the analytical results.

Analytical method precision and accuracy was monitored by laboratory control standards which included matrix spike, duplicate and quality control analyses. These standards were determined to be within established laboratory method acceptance limits.

Individual sample performance was monitored by the addition of surrogate analytes to each sample. All surrogate recovery data was determined to be within laboratory QA/QC guidelines unless otherwise noted.

Reviewed by,

Harry B. Locker, Ph.D.
Laboratory Director

enclosures



ENDYNE, INC.

Laboratory Services

32 James Brown Drive
Williston, Vermont 05495
(802) 879-4333
FAX 879-7103

EPA METHOD 602--PURGEABLE AROMATICS

CLIENT: Twin State Environmental Corp.

DATE RECEIVED: April 21, 1999

PROJECT NAME: Lewis Oil/#98112

REPORT DATE: April 28, 1999

CLIENT PROJ. #: 98112

ORDER ID: 2060

Ref. #:	137,289	137,290	137,291	137,292	137,293
Site:	MW-1	MW-2	MW-3	GP-4	GP-5
Date Sampled:	4/21/99	4/21/99	4/21/99	4/21/99	4/21/99
Time Sampled:	11:49	12:01	12:30	12:13	12:20
Sampler:	B.W.	B.W.	B.W.	B.W.	B.W.
Date Analyzed:	4/27/99	4/27/99	4/27/99	4/25/99	4/26/99
UIP Count:	> 10	> 10	4	> 10	> 10
Dil. Factor (%):	100	20	100	5	10
Surr % Rec. (%):	84	ESTD	89	91	82
Parameter	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)
MTBE	<10	<50	<10	<200	<100
Benzene	<1	63.2	1.2	40.0	<10
Toluene	<1	23.6	<1	26.2	<10
Ethylbenzene	1.1	73.6	<1	492.	31.3
Xylenes	6.3	269.	2.0	2,400.	47.2
Chlorobenzene	<1	<5	<1	<20	<10
1,3-Dichlorobenzene	<1	<5	<1	<20	<10
1,4-Dichlorobenzene	<1	<5	<1	<20	<10
1,2-Dichlorobenzene	<1	<5	<1	<20	<10

Ref. #:	137,294	137,295			
Site:	Dup-1	E.B.			
Date Sampled:	4/21/99	4/21/99			
Time Sampled:	12:16	11:35			
Sampler:	B.W.	B.W.			
Date Analyzed:	4/27/99	4/27/99			
UIP Count:	> 10	0			
Dil. Factor (%):	20	100			
Surr % Rec. (%):	ESTD	101			
Parameter	Conc. (ug/L)	Conc. (ug/L)			
MTBE	<50	<10			
Benzene	63.4	<1			
Toluene	23.5	<1			
Ethylbenzene	80.7	<1			
Xylenes	274.	<1			
Chlorobenzene	<5	<1			
1,3-Dichlorobenzene	<5	<1			
1,4-Dichlorobenzene	<5	<1			
1,2-Dichlorobenzene	<5	<1			

Note: UIP = Unidentified Peaks TBQ = Trace Below Quantitation NI = Not Indicated

ESTD = External standard used due to coelution with internal standard.



≡ENDYNE, INC.

32 James Brown Drive
Williston, Vermont 05495
(602) 879-4333

CHAIN-OF-CUSTODY RECORD

27958

Project Name: LEWIS DIL 98112	Reporting Address: 34 Roseville Highway Winchester, VT 05446	Billing Address:
Site Location: ST. Johnsbury, VT		
Endyne Project Number: 2060	Company: TSEL Contact Name/Phone #: 603-866-3120	Sampler Name: Phone #:

[illegible]

Relinquished by: Signature <i>[Signature]</i>	Received by: Signature <i>[Signature]</i>	Date/Time <i>4/17/2010</i>
Relinquished by: Signature	Received by: Signature	Date/Time

New York State Project: Yes No ☒

Requested Analyses

[illegible]

APPENDIX B



TWIN STATE ENVIRONMENTAL CORPORATION

Page 1 of 1

34 Roosevelt Highway - Colchester, Vermont 05446
(802) 654-8663 FAX: (802) 654-8667

MONITORING WELL/SOIL BORING LOG

WELL/BORING NO:	B-101	WELL DEPTH:	N/A	BORING DEPTH:	12.0 ft
PROJECT NAME:	Lewis Oil Co.	DEPTH TO WATER:	~3.5 ft on 3/23/99		
PROJECT NO:	98112	SCREEN DIA:	N/A	DEPTH:	N/A
INSTALL DATE:	March 23, 1999	SCREEN TYPE/SIZE:	N/A		
TSEC REP:	John Diego	RISER TYPE:	N/A		
DRILLING CO:	TSEC	RISER DIA.:	N/A	DEPTH:	N/A
DRILLING METHOD:	Geoprobe®	GUARD TYPE:	N/A		
SAMPLING METHOD:	Macrocore Sampler	RISER CAP:	N/A		
REMARKS:	Boring was backfilled with drill cuttings, sand, and bentonite, and finished to match existing surface.				

DEPTH IN FEET	WELL PROFILE	SAMPLE DEPTH (FT)	PID (PPMV)	BLOWS/6" AND RECOVERY	SOIL DESCRIPTION AND NOTES	LEGEND
0	N	0-4	<0.1	2.75 ft recovery	0.0-1.9: Brown SAND with little gravel. 1.9-2.75: Fine brown SAND with trace of silt. Very loose.	CEMENT GROUT
1	O					NATIVE BACKFILL
2						BENTONITE SEAL
3	W					SAND PACK
4	E	4-8	<0.1	3.6 ft recovery	4.0-7.6: Fine brown SAND. Wet, loose.	WELL SCREEN
5	L					RISER PIPE
6	L					HS HEAD SPACE
7						WATER LEVEL (APPROXIMATE)
8	I	8-12	<0.1	4.0 ft recovery	8.0-10.0: Fine brown SAND. 10.0-12.0: Brown coarse GRAVEL.	
9	N					
10	S					
11	T					
12	A				End of Sampling = 12.0 feet End of Boring = 12.0 feet	
13	L					
14	L					
15	E					
16	D					
17						
18						
19						
20						
21						
22						
23						
24						
25						
GRANULAR SOILS		COHESIVE SOILS		PROPORTIONS USED		NOTES: 1. See Figure 2, SITE Plan, for boring locations 2. PID readings were obtained using a Thermo Environmental Instruments Model 580 B PID equipped with a 10.6eV lamp. Conventional headspace techniques were used.
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	TRACE	0-10%	
0-4	V.LOOSE	<2	V.SOFT	LITTLE	10-20%	
4-10	LOOSE	2-4	SOFT	SOME	20-35%	
10-30	M.DENSE	4-8	M.STIFF	AND	35-50%	
30-50	DENSE	8-15	STIFF			
>50	V.DENSE	15-30	V.STIFF			
		>30	HARD			



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MONITORING WELL/SOIL BORING LOG

WELL/BORING NO:	B-102	WELL DEPTH:	N/A	BORING DEPTH:	12.0 ft
PROJECT NAME:	Lewis Oil Co.	DEPTH TO WATER:	Not indicated		
PROJECT NO:	98112	SCREEN DIA:	N/A	DEPTH:	N/A
INSTALL DATE:	March 23, 1999	SCREEN TYPE/SIZE:	N/A		
TSEC REP:	John Diego	RISER TYPE:	N/A		
DRILLING CO:	TSEC	RISER DIA.:	N/A	DEPTH:	N/A
DRILLING METHOD:	Geoprobe®	GUARD TYPE:	N/A		
SAMPLING METHOD:	Macrocore Sampler	RISER CAP:	N/A		
REMARKS:	Boring was backfilled with drill cuttings, sand, and bentonite, and finished to match existing surface.				

DEPTH IN FEET	WELL PROFILE	SAMPLE DEPTH (FT)	PID (PPMV)	BLOWS/6" AND RECOVERY	SOIL DESCRIPTION AND NOTES	LEGEND
0	N	0-4	0.8	3.5 ft recovery	0.0-3.5: Fine brown SAND with traces of coal. Loose.	CEMENT GROUT
1	O					NATIVE BACKFILL
2						BENTONITE SEAL
3	W					SAND PACK
4	E	4-8	1.0	4.0 ft recovery	4.0-7.0: Fine brown SAND. 7.0-7.5: Fine brown SAND with trace of silt. Light oil sheen at 7.0 ft. 7.5-8.0: Coarse SAND with some gravel with weathered sheen.	WELL SCREEN
5	L					RISER PIPE
6	L					HEAD SPACE
7						WATER LEVEL (APPROXIMATE)
8	I	8-12	0.2	4.0 ft recovery	8.0-11.0: Coarse SAND, gray. 11.0-12.0: Coarse SAND with little gravel. Oxidized at 11.0 ft.	
9	N					
10	S					
11	T					
12	A				End of Sampling = 12.0 feet End of Boring = 12.0 feet	
13	L					
14	L					
15	E					
16	D					
17						
18						
19						
20						
21						
22						
23						
24						
25						
GRANULAR SOILS		COHESIVE SOILS		PROPORTIONS USED		NOTES: 1. See Figure 2, SITE Plan, for boring locations 2. PID readings were obtained using a Thermo Environmental Instruments Model 580 B PID equipped with a 10.6eV lamp. Conventional headspace techniques were used.
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	TRACE	0-10%	
0-4	V.LOOSE	<2	V.SOFT	LITTLE	10-20%	
4-10	LOOSE	2-4	SOFT	SOME	20-35%	
10-30	M.DENSE	4-8	M.STIFF	AND	35-50%	
30-50	DENSE	8-15	STIFF			
>50	V.DENSE	15-30	V.STIFF			
		>30	HARD			



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MONITORING WELL/SOIL BORING LOG

WELL/BORING NO:	B-103	WELL DEPTH:	N/A	BORING DEPTH:	12.0 ft
PROJECT NAME:	Lewis Oil Co.	DEPTH TO WATER:	Not indicated		
PROJECT NO:	98112	SCREEN DIA:	N/A	DEPTH:	N/A
INSTALL DATE:	March 23, 1999	SCREEN TYPE/SIZE:	N/A		
TSEC REP:	John Diego	RISER TYPE:	N/A		
DRILLING CO:	TSEC	RISER DIA.:	N/A	DEPTH:	N/A
DRILLING METHOD:	Geoprobe®	GUARD TYPE:	N/A		
SAMPLING METHOD:	Macrocore Sampler	RISER CAP:	N/A		
REMARKS:	Boring was backfilled with drill cuttings, sand, and bentonite, and finished to match existing surface.				

DEPTH IN FEET	WELL PROFILE	SAMPLE DEPTH (FT)	PID (PPMV)	BLOWS/6" AND RECOVERY	SOIL DESCRIPTION AND NOTES	LEGEND
0	N	0-4	534	Not Indicated	0.0-2.5: Brown medium SAND with trace of gravel (fill). Very loose.	CEMENT GROUT
1	O				2.5-3.5: Fine brown SAND with trace of silt.	NATIVE BACKFILL
2					3.5-4.0: Stained SAND with trace of silt. Petro odor, dry with coal "clinkers."	
3	W					
4	E	4-8	458 (4.5')	Not Indicated	4.0-5.0: Brown stained fine SAND. Wet with petroleum odor.	BENTONITE SEAL
5	L				5.0-8.0: Gray fine SAND.	SAND PACK
6	L					
7			277 (9.0')			WELL SCREEN
8	I	8-12	NS	Not Indicated	8.0-11.0: Gray fine SAND. Wet, very loose.	
9	N				11.0-12.0: Well sorted coarse SAND with some gravel. (wood at 11.5')	RISER PIPE
10	S					
11	T					
12	A				End of Sampling = 12.0 feet End of Boring = 12.0 feet	HS HEAD SPACE
13	L					
14	L					WATER LEVEL (APPROXIMATE)
15	E					
16	D					
17						
18						
19						
20						
21						
22						
23						
24						
25						
GRANULAR SOILS		COHESIVE SOILS		PROPORTIONS USED	NOTES: 1. See Figure 2, SITE Plan, for boring locations 2. PID readings were obtained using a Thermo Environmental Instruments Model 580 B PID equipped with a 10.6eV lamp. Conventional headspace techniques were used.	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	TRACE		
0-4	V.LOOSE	<2	V.SOFT	LITTLE		
4-10	LOOSE	2-4	SOFT	SOME		
10-30	M.DENSE	4-8	M.STIFF	AND		
30-50	DENSE	8-15	STIFF			
>50	V.DENSE	15-30	V.STIFF			
		>30	HARD			



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MONITORING WELL/SOIL BORING LOG

WELL/BORING NO:	B-104	WELL DEPTH:	N/A	BORING DEPTH:	12.0 ft
PROJECT NAME:	Lewis Oil Co.	DEPTH TO WATER:	Not indicated		
PROJECT NO:	98112	SCREEN DIA:	N/A	DEPTH:	N/A
INSTALL DATE:	March 23, 1999	SCREEN TYPE/SIZE:	N/A		
TSEC REP:	John Diego	RISER TYPE:	N/A		
DRILLING CO:	TSEC	RISER DIA.:	N/A	DEPTH:	N/A
DRILLING METHOD:	Geoprobe®	GUARD TYPE:	N/A		
SAMPLING METHOD:	Macrocore Sampler	RISER CAP:	N/A		
REMARKS:	Boring was backfilled with drill cuttings, sand, and bentonite, and finished to match existing surface.				

DEPTH IN FEET	WELL PROFILE	SAMPLE DEPTH (FT)	PID (PPMV)	BLOWS/6" AND RECOVERY	SOIL DESCRIPTION AND NOTES	LEGEND
0	N	0-4	178	3.3 ft recovery	0.0-4.0: Medium gray SAND with trace of gravel (fill). Petroleum odor.	CEMENT GROUT
1	O					NATIVE BACKFILL
2						BENTONITE SEAL
3	W					SAND PACK
4	E	4-8	221	3.3 ft recovery	4.0-6.0: Medium gray SAND with some gravel.	WELL SCREEN
5	L				6.0-7.5: Gray fine SAND.	RISER PIPE
6	L				7.5-8.0: Brown fine to medium SAND with trace of silt. Wet.	
7						
8	I	8-12	127	4.0 ft recovery	8.0-10.5: Gray/Brown SAND with little silt. Wet.	
9	N				10.5-12.0: Coarse SAND and GRAVEL. Saturated with oil.	
10	S					
11	T					
12	A				End of Sampling = 12.0 feet End of Boring = 12.0 feet	HS HEAD SPACE
13	L					
14	L					WATER LEVEL (APPROXIMATE)
15	E					
16	D					
17						
18						
19						
20						
21						
22						
23						
24						
25						
GRANULAR SOILS		COHESIVE SOILS		PROPORTIONS USED		NOTES: 1. See Figure 2, SITE Plan, for boring locations 2. PID readings were obtained using a Thermo Environmental Instruments Model 580 B PID equipped with a 10.6eV lamp. Conventional headspace techniques were used.
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	TRACE	0-10%	
0-4	V.LOOSE	<2	V.SOFT	LITTLE	10-20%	
4-10	LOOSE	2-4	SOFT	SOME	20-35%	
10-30	M.DENSE	4-8	M.STIFF	AND	35-50%	
30-50	DENSE	8-15	STIFF			
>50	V.DENSE	15-30	V.STIFF			
		>30	HARD			



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MONITORING WELL/SOIL BORING LOG

WELL/BORING NO:	B-105/MW-1	WELL DEPTH:	11.0 ft	BORING DEPTH:	12.0 ft
PROJECT NAME:	Lewis Oil Co.	DEPTH TO WATER:	3.82 ft on 4/21/99		
PROJECT NO:	98112	SCREEN DIA:	1 1/2-inch	DEPTH:	1.0-11.0 ft bg
INSTALL DATE:	March 23, 1999	SCREEN TYPE/SIZE:	Schedule 40 PVC, 0.010-slot		
TSEC REP:	John Diego	RISER TYPE:	Schedule 40 PVC		
DRILLING CO:	TSEC	RISER DIA:	1 1/2-inch	DEPTH:	0.5-1.0 ft bg
DRILLING METHOD:	Geoprobe®	GUARD TYPE:	Aluminum Road Box set in concrete		
SAMPLING METHOD:	Macrocore Sampler	RISER CAP:	Locking expansion plug.		
REMARKS:	Boring was completed as a groundwater monitoring well.				

DEPTH IN FEET	WELL PROFILE	SAMPLE DEPTH (FT)	PID (PPMV)	BLOWS/6" AND RECOVERY	SOIL DESCRIPTION AND NOTES	LEGEND
0		0-4	<0.1	3.0 ft recovery	0.0-4.0: Brown fine SAND with some silt. Dry.	CEMENT GROUT
1						NATIVE BACKFILL
2						BENTONITE SEAL
3						SAND PACK
4		4-8	NR	3.4 ft recovery	4.0-8.0: Brown fine SAND. Very loose, wet.	WELL SCREEN
5						RISER PIPE
6						HEAD SPACE
7						WATER LEVEL (APPROXIMATE)
8		8-12	NR	4.0 ft recovery	8.0-10.0: Brown fine SAND. Very loose. 10.0-10.5: Brown medium SAND. Very loose. 10.5-12.0: Gray coarse SAND and GRAVEL. Very loose.	
9						
10						
11						
12					End of Sampling = 12.0 feet End of Boring = 12.0 feet	
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
GRANULAR SOILS		COHESIVE SOILS		PROPORTIONS USED		NOTES: 1. See Figure 2, SITE Plan, for boring locations 2. PID readings were obtained using a Thermo Environmental Instruments Model 580 B PID equipped with a 10.6eV lamp. Conventional headspace techniques were used.
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	TRACE	0-10%	
0-4	V.LOOSE	<2	V.SOFT	LITTLE	10-20%	
4-10	LOOSE	2-4	SOFT	SOME	20-35%	
10-30	M.DENSE	4-8	M.STIFF	AND	35-50%	
30-50	DENSE	8-15	STIFF			
>50	V.DENSE	15-30	V.STIFF			
		>30	HARD			



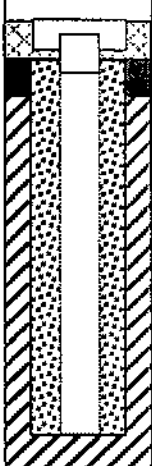







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MONITORING WELL/SOIL BORING LOG

WELL/BORING NO:	B-106/MW-2	WELL DEPTH:	11.0 ft	BORING DEPTH:	12.0 ft
PROJECT NAME:	Lewis Oil Co.	DEPTH TO WATER:	4.73 ft on 4/21/99		
PROJECT NO:	98112	SCREEN DIA:	1½-inch	DEPTH:	1.0-11.0 ft bg
INSTALL DATE:	March 23, 1999	SCREEN TYPE/SIZE:	Schedule 40 PVC, 0.010-slot		
TSEC REP:	John Diego	RISER TYPE:	Schedule 40 PVC		
DRILLING CO:	TSEC	RISER DIA:	1½-inch	DEPTH:	0.5-1.0 ft bg
DRILLING METHOD:	Geoprobe®	GUARD TYPE:	Aluminum Road Box set in concrete		
SAMPLING METHOD:	Macrocore Sampler	RISER CAP:	Locking expansion plug.		
REMARKS:	Boring was completed as a groundwater monitoring well.				

DEPTH IN FEET	WELL PROFILE	SAMPLE DEPTH (FT)	PID (PPMV)	BLOWS/6" AND RECOVERY	SOIL DESCRIPTION AND NOTES	LEGEND
0		0-4	7.0	3.0 ft recovery	0.0-3.5: Fill (unspecified). 3.5-3.7: Black stained GRAVEL. 3.7-4.0: Brown fine SAND with some silt.	 CEMENT GROUT
1						
2						 NATIVE BACKFILL
3						
4		4-8	439	2.3 ft recovery	4.0-8.0: Fine brown SAND. Wet, strong gasoline odor.	 BENTONITE SEAL
5						
6						 SAND PACK
7						
8		8-12	133	Not indicated	8.0-10.0: Fine brown SAND. Wet, strong gasoline odor. 10.0-12.0: Gray medium SAND with trace of gravel.	 WELL SCREEN
9						
10						 RISER PIPE
11						
12					End of Sampling = 12.0 feet End of Boring = 12.0 feet	HS HEAD SPACE
13						
14						 WATER LEVEL (APPROXIMATE)
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
GRANULAR SOILS		COHESIVE SOILS		PROPORTIONS USED		NOTES: 1. See Figure 2, SITE Plan, for boring locations 2. PID readings were obtained using a Thermo Environmental Instruments Model 580 B PID equipped with a 10.6eV lamp. Conventional headspace techniques were used.
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	TRACE	0-10%	
0-4	V.LOOSE	<2	V.SOFT	LITTLE	10-20%	
4-10	LOOSE	2-4	SOFT	SOME	20-35%	
10-30	M.DENSE	4-8	M.STIFF	AND	35-50%	
30-50	DENSE	8-15	STIFF			
>50	V.DENSE	15-30	V.STIFF			
		>30	HARD			



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MONITORING WELL/SOIL BORING LOG

WELL/BORING NO:	B-107	WELL DEPTH:	N/A	BORING DEPTH:	12.0 ft
PROJECT NAME:	Lewis Oil Co.	DEPTH TO WATER:	Not indicated		
PROJECT NO:	98112	SCREEN DIA:	N/A	DEPTH:	N/A
INSTALL DATE:	March 23, 1999	SCREEN TYPE/SIZE:	N/A		
TSEC REP:	John Diego	RISER TYPE:	N/A		
DRILLING CO:	TSEC	RISER DIA.:	N/A	DEPTH:	N/A
DRILLING METHOD:	Geoprobe®	GUARD TYPE:	N/A		
SAMPLING METHOD:	Macrocore Sampler	RISER CAP:	N/A		
REMARKS:	Boring was backfilled with drill cuttings, sand, and bentonite, and finished to match existing surface.				

DEPTH IN FEET	WELL PROFILE	SAMPLE DEPTH (FT)	PID (PPMV)	BLOWS/6" AND RECOVERY	SOIL DESCRIPTION AND NOTES	LEGEND
0	N	0-4	NR	No recovery	0.0-4.0: No sample recovery	CEMENT GROUT
1	O					NATIVE BACKFILL
2						BENTONITE SEAL
3	W					SAND PACK
4	E	4-8	9.5	3.3 ft recovery	4.0-5.0: Coarse SAND.	WELL SCREEN
5	L		(07')		5.0-8.0: Fine SAND with some silt. Sheens, wet, very loose.	RISER PIPE
6	L					HS HEAD SPACE
7			7.0			WATER LEVEL (APPROXIMATE)
8	I		(08')		End of Sampling = 8.0 feet End of Boring = 8.0 feet	
9	N					
10	S					
11	T					
12	A					
13	L					
14	L					
15	E					
16	D					
17						
18						
19						
20						
21						
22						
23						
24						
25						
GRANULAR SOILS		COHESIVE SOILS		PROPORTIONS USED		NOTES: 1. See Figure 2, SITE Plan, for boring locations 2. PID readings were obtained using a Thermo Environmental Instruments Model 580 B PID equipped with a 10.6eV lamp. Conventional headspace techniques were used.
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	TRACE	0-10%	
0-4	V.LOOSE	<2	V.SOFT	LITTLE	10-20%	
4-10	LOOSE	2-4	SOFT	SOME	20-35%	
10-30	M.DENSE	4-8	M.STIFF	AND	35-50%	
30-50	DENSE	8-15	STIFF			
>50	V.DENSE	15-30	V.STIFF			
		>30	HARD			



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MONITORING WELL/SOIL BORING LOG

WELL/BORING NO:	B-109/MW-4	WELL DEPTH:	11.0 ft	BORING DEPTH:	12.0 ft
PROJECT NAME:	Lewis Oil Co.	DEPTH TO WATER:	4.73 ft on 4/21/99		
PROJECT NO:	98112	SCREEN DIA:	1½-inch	DEPTH:	1.0-11.0 ft bg
INSTALL DATE:	March 24, 1999	SCREEN TYPE/SIZE:	Schedule 40 PVC, 0.010-slot		
TSEC REP:	John Diego	RISER TYPE:	Schedule 40 PVC		
DRILLING CO:	TSEC	RISER DIA:	1½-inch	DEPTH:	0.5-1.0 ft bg
DRILLING METHOD:	Geoprobe®	GUARD TYPE:	Aluminum Road Box set in concrete		
SAMPLING METHOD:	Macrocore Sampler	RISER CAP:	Locking expansion plug.		
REMARKS:	Boring was completed as a groundwater monitoring well.				

DEPTH IN FEET	WELL PROFILE	SAMPLE DEPTH (FT)	PID (PPMV)	BLOWS/6" AND RECOVERY	SOIL DESCRIPTION AND NOTES	LEGEND
0		0-4	362	Not indicated	0.0-2.0: Granular fill (unspecified). 2.0-3.0: Gray medium SAND. Dry, very loose. 3.0-4.0: Gray fine to medium SAND with trace of silt. Petroleum odor.	CEMENT GROUT NATIVE BACKFILL
1						
2						
3						
4		4-8	28	Not indicated	4.0-7.0: Gray fine to medium SAND with trace of silt. Petroleum odor. 7.0-7.5: Gray coarse SAND. 7.5-8.0: Gray fine SAND with trace of silt. Wet, sheen, very loose.	BENTONITE SEAL SAND PACK
5						
6						
7						
8		8-12	25	Not indicated	8.0-10.0: Gray fine SAND with trace of silt. 10.0-12.0: Coarse SAND and GRAVEL. Wet, very loose.	WELL SCREEN RISER PIPE
9						
10						
11						
12					End of Sampling = 12.0 feet End of Boring = 12.0 feet	HS HEAD SPACE WATER LEVEL (APPROXIMATE)
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
GRANULAR SOILS		COHESIVE SOILS		PROPORTIONS USED		NOTES: 1. See Figure 2, SITE Plan, for boring locations 2. PID readings were obtained using a Thermo Environmental Instruments Model 580 B PID equipped with a 10.6eV lamp. Conventional headspace techniques were used.
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	TRACE	0-10%	
0-4	V.LOOSE	<2	V.SOFT	LITTLE	10-20%	
4-10	LOOSE	2-4	SOFT	SOME	20-33%	
10-30	M.DENSE	4-8	M.STIFF	AND	35-50%	
30-50	DENSE	8-15	STIFF			
>50	V.DENSE	15-30	V.STIFF			
		>30	HARD			



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MONITORING WELL/SOIL BORING LOG

WELL/BORING NO:	B-110	WELL DEPTH:	N/A	BORING DEPTH:	12.0 ft
PROJECT NAME:	Lewis Oil Co.	DEPTH TO WATER:	Not indicated		
PROJECT NO:	98112	SCREEN DIA:	N/A	DEPTH:	N/A
INSTALL DATE:	March 24, 1999	SCREEN TYPE/SIZE:	N/A		
TSEC REP:	John Diego	RISER TYPE:	N/A		
DRILLING CO:	TSEC	RISER DIA.:	N/A	DEPTH:	N/A
DRILLING METHOD:	Geoprobe®	GUARD TYPE:	N/A		
SAMPLING METHOD:	Macrocore Sampler	RISER CAP:	N/A		
REMARKS:	Boring was backfilled with drill cuttings, sand, and bentonite, and finished to match existing surface.				

DEPTH IN FEET	WELL PROFILE	SAMPLE DEPTH (FT)	PID (PPMV)	BLOWS/6" AND RECOVERY	SOIL DESCRIPTION AND NOTES	LEGEND
0	N	0-4	<0.1	Not Indicated	0.0-3.0: Granular fill	CEMENT GROUT
1	O				3.0-4.0: Brown fine SAND with trace of silt. Very loose, dry.	NATIVE BACKFILL
2						
3	W	4-8	<0.1	Not Indicated	4.0-8.0: Brown fine SAND with trace of silt. Very loose, dry.	BENTONITE SEAL
4	E					
5	L					
6	L	8-12	<0.1	Not Indicated	8.0-10.0: Brown fine SAND with trace of silt. Very loose, dry.	SAND PACK
7					10.0-12.0: Medium SAND and GRAVEL. Very loose, wet.	WELL SCREEN
8	I					
9	N					RISER PIPE
10	S					
11	T					
12	A				End of Sampling = 12.0 feet End of Boring = 12.0 feet	HS HEAD SPACE
13	L					
14	L					
15	E					WATER LEVEL (APPROXIMATE)
16	D					
17						
18						
19						
20						
21						
22						
23						
24						
25						
GRANULAR SOILS		COHESIVE SOILS		PROPORTIONS USED		NOTES: 1. See Figure 2, SITE Plan, for boring locations 2. PID readings were obtained using a Thermo Environmental Instruments Model 580 B PID equipped with a 10.6eV lamp. Conventional headspace techniques were used.
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY	TRACE	0-10%	
0-4	V.LOOSE	<2	V.SOFT	LITTLE	10-20%	
4-10	LOOSE	2-4	SOFT	SOME	20-35%	
10-30	M.DENSE	4-8	M.STIFF	AND	35-50%	
30-50	DENSE	8-15	STIFF			
>50	V.DENSE	15-30	V.STIFF			
		>30	HARD			

ATTACHMENT 1



State of Vermont

Department of Fish and Wildlife

Department of Forests, Parks and Recreation

Department of Environmental Conservation

State Geologist

RELAY SERVICE FOR THE HEARING IMPAIRED

1-800-253-0191 TDD>Voice

1-800-253-0195 Voice>TDD

 AGENCY OF NATURAL RESOURCES
 Department of Environmental Conservation
 Waste Management Division

 103 South Main Street / West Building
 Waterbury, Vermont 05671-0404

802-241-3886

Fax 802-241-3296

February 17, 1999

 KENDAL LEGENDRE
 FRED W LEWIS OIL COMPANY
 1 PARKER COURT
 ST JOHNSBURY VT 05819

RE: Work Plan dated January 22, 1999, to Investigate Petroleum Contamination at the Lewis Oil Company Site, Saint Johnsbury, Vermont (Site #98-2484)

Dear Mr. Legendre:

The Sites Management Section (SMS) has reviewed the above referenced work plan by Twin State Environmental Corporation (TSEC). The proposed work includes advancing at least ten soil borings, with four of the borings being completed as monitoring wells. Groundwater samples will be collected from two existing monitoring wells and the four newly installed monitoring wells. The samples will be analyzed for volatile organic compounds (VOCs) using EPA Method 8021b and for total petroleum hydrocarbons (TPH) using modified EPA Method 8100. TSEC will prepare a report summarizing the site characterization and monitoring activities.

The SMS approves the work plan and cost estimate. Subject to the following conditions, the Petroleum Cleanup Funds (PCF) will reimburse total costs not exceeding \$7,882.00:

- The initial \$1,000.00 PCF deductible is met, as referenced in our letter dated September 30, 1998;
- Costs follow the Consultant's Fee Schedule contained in the "Site Investigation Guidance" document dated August 1996; and
- The "Procedures for Reimbursement from the PCF" dated September 1995 are followed.

Please notify the SMS within 30 days of receiving this letter of the proposed schedule to complete the approved activities. If you have any questions or comments, please contact me at 802-241-3886.

Sincerely,

 John Schmeltzer, Site Project Manager
 Sites Management Section

 cc: John R. Diego, Twin State Environmental Corporation
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